CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Kira F. Anderson

Project Number
J1801

Project Title
Super Boats: How to Make Non Floating Solids Float

Abstract

Objectives/Goals
The objective of this study is to determine what allows boats made of steel or other non floating material to float.

Methods/Materials
Materials: polymer clay, graduated pitcher, scale, water, rolling pin, oven, cutting board, computer, internet. Looked up research on this topic, discovered Archimedes principle. Tried to float polymer in its block state. Created two different designs of boats, they floated and then measured the displaced water to see the application of Archimedes principle.

Results
Several shapes of the solid were tested to see if they float. Once the volume of the displaced water was converted to mass, it was evident that when the mass of the boat is less than the mass of the displaced water, the boat will float, therefore proving Archimedes' principle.

Conclusions/Discussion
In simple terms, Archimedes# principle states that the mass of the water displaced by the object must be greater than the mass of the object in order for the object to float. So, my models were able to float because by putting sides on the model, they were able to take up more #space# therefore displacing more water to allow it to float. My hypothesis was correct, it does have to do with the shape...and so much more!!

Summary Statement
I showed that if the shape of an object that does not float is modified, that it can be made to float.

Help Received
I designed and built the boats by myself. I got help understanding Archimedes' principle from my grandpa, a kayak instructor. I got help in understanding how to use ratios to convert volume to mass from my mom.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Darren I. Apostol

Project Number
J1802

Project Title
Does Altitude Affect the Amount of Background Radiation?

Abstract

Objectives/Goals
The objective of this study is to see if the altitude of an area affects the amount of background radiation in it.

Methods/Materials
A cloud chamber, which shows the tracks of radiation particles that go through it in a mist, was used to detect radiation and its frequency, and was made using a lidded cup, felt, clay, rubbing alcohol as the mist, and dry ice as a cooling agent. I set up a cloud chamber at five altitudes above sea level: one at 20 ft. (by the sea), 200 ft. (city), 400 ft. (hills), 830 ft. (suburbs), and 1550 ft. (mountains). A video camera was used to record each in action for 10 minutes, and the recording was played back to count the number of radiation tracks.

Results
The 20 ft. trial had 50 tracks, the 200 ft. trial had 254 tracks, the 400 ft. trial had 61 tracks, the 830 ft. trial had 137 tracks, and the 1550 ft. trial had 171 tracks. This may indicate an increase in radiation as altitude goes up.

Conclusions/Discussion
My hypothesis was that background radiation increased with altitude, and the experimental results support it. Excluding the trial at 200 ft., which was the only trial based in a city, the experiments showed an increase in radiation tracks as the altitude went up. The city trial was excluded due to factors such as increased radioactive material (like some heavy metals) in construction materials.

Summary Statement
By testing the amount of background radiation at different altitudes, I discovered that it is affected by altitude and increases as altitude goes up.

Help Received
None. I researched about and built the cloud chamber myself and researched independently about background radiation.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Madisen F. Berube

Project Number

J1803

Project Title

The Effect of Mass and Revolutions on a Slingatron Projectile's Velocity

Abstract

Objectives/Goals

The goal of this project was to determine whether the mass and revolutions of a slingatron affect the velocity of the projectile being launched. A slingatron is a mechanical hypervelocity mass accelerator that is an efficient method to launch payloads such as building materials into space. Space is mankind's next step to explore natural resources, but the cost of rockets is high so developing more efficient methods of space exploration is important.

Methods/Materials

A slingatron was constructed with the help of an HSU equipment technician using a Bobcad system to program a Bridgeport milling machine that cut two acrylic models (one with 4 revolutions, one with 1 revolution) in a spiral pattern to test how revolutions affect velocity. A small battery powered motor was used to drive an acrylic arm that pushed the projectile through the revolutions. The velocity of a plastic sphere (.4992 g) and then also of a metal sphere (2.88 g) projectile were measured as they exited the slingatron using a light sensitive speed reader. Both mass of the projectile and number of revolutions were considered.

Results

The 4 revolution spiral with a plastic projectile had the greatest velocity with an average of 53.55 m/sec. The 1 revolution spiral with a plastic projectile had the slowest velocity with an average of 40.08 m/sec. The heavier metal sphere also had a higher velocity with the multiple revolutions than single revolution, but was slower in comparison with the plastic. The results show that the amount of revolutions and projectile mass do affect velocity. The number of revolutions did increase the velocity for both projectiles, but the lower mass projectile had a greater increase.

Conclusions/Discussion

The model slingatron can help us understand how to build a slingatron that could actually launch payloads into space. A formula that represents revolutions, mass, and the velocity needed to exit earth#s atmosphere could be applied to a real life scenario. Payloads of materials needed to build satellites, space stations, fuel, water, etc. that would allow a broad exploration of space without the costly expense of constant rocket launches. Currently, private companies are attempting to build a large slingatron. If this technology is perfected, it could be used in interplanetary space exploration.

Summary Statement

I built a slingatron to investigate how a projectile#s mass and slingatron#s revolutions affected velocity in order to model how large scale slingatron#s could create the needed acceleration for optimum velocity to exit the Earth#s atmosphe

Help Received

I received guidance from Marty Reed, Equipment Technician at Humboldt State University, who assisted in the development of my project idea and taught me to use specialized equipment, which is one of the reasons my results are accurate.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Holly E. Carter

Project Number
J1804

Project Title
How Do the Sound Properties of a Glass Goblet Depend on the Amount of Liquid?

Abstract

Objectives/Goals
A glass goblet can be excited to produce a ringing sounds with a utensil, a wet finger, or the sound of a human voice. The properties of the sound, such as the pitch and duration, depend on the type and amount of liquid the goblet contains and my purpose was to measure these effects.

My hypothesis was that if the amount of liquid in a glass is increased, the pitch will decrease because energy is lost to the liquid and the duration of the sound will be shorter because of damping. I expected these effects to be more pronounced with denser liquids.

Methods/Materials
For each test, I filled the goblet with water, measured the volume using the measured density and a digital scale, started recording the sounds with Sound Analyzer app, and struck the goblet multiple times with the knife. I used the Sound Analyzer app to calculate a spectrogram of each recording. I measured the frequencies of the fundamental and the first overtone and the power of the fundamental frequency as a function of time.

Results
The resonant frequency of the fundamental and overtones decreased with the amount of liquid. Acoustic power of the fundamental faded at a constant rate. The rate of power loss of the fundamental decreased slightly but noticeably with the amount of water in the goblet, but increased dramatically with the amount of syrup.

Conclusions/Discussion
The pitch decreased as liquid was added to the glass, gradually at first and then more rapidly. The decrease was slightly larger for syrup than for water, as I expected. The duration of the sound decreased rapidly as syrup was added to the glass, as I expected. However, it increased slightly with the amount of water. This was an unexpected result and I am not sure why this happened. The results of my experiment can help understand the transfer of acoustic energy between solids and liquids and revealed some very interesting and unexpected patterns.

Summary Statement
My project reveals detailed and unexpected patterns in the acoustic properties of a glass goblet filled with different types and amounts of liquid.

Help Received
I performed the experiment and analysis myself. My father, Dr. Paul Carter, helped me find out more about acoustics and spectrograms.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Corina Dunn

Project Number
J1805

Project Title
The Effects of Temperature and Material on the Speed of Sound in a Gas

Abstract

Objectives/Goals
This project was designed to test how temperature and material affect the speed of sound in a gas. I tested the hypothesis that if the temperature is changed, then the speed of sound is proportional to temperature. I also tested the hypothesis that if the material is changed, then the speed of sound is inversely related to the molecular weight of the gas.

Methods/Materials
To perform the measurements, an ultrasonic range finder was attached to one side of a 1 m long, 4-in. diameter PVC pipe. The ultrasonic range finder was used to determine the speed of sound at various temperatures through air, and near room temperature for carbon dioxide and helium. To heat the air, the PVC pipe was wrapped in an electric blanket, and a towel for insulation. To cool the air, the PVC pipe was covered in ice, and a towel for insulation. A kitchen thermometer was used to measure the temperature.

Results
As the temperature increased, so did the speed of sound at a rate of 0.6739 (m/s)/degree K. This agrees well with the accepted rate of 0.6(m/s)/degree K. The speed of sound in helium was measured to be much higher than that of air, but the equipment was unable to measure the exact speed. The speed of sound in carbon dioxide at 292.04° Kelvin was measured as 277.70 m/s. This is similar to the accepted speed of sound for 292.04° Kelvin in carbon dioxide, which is 266.67 m/s.

Conclusions/Discussion
The results concurred with the hypothesis; in a gas, the speed of sound is proportional to temperature and inversely related to the molecular weight of the material. Sources of error are discussed.

Summary Statement
I measured that, in a gas, the speed of sound is proportional to temperature and inversely related to the molecular weight of the material.

Help Received
I received general advice from my parents, as well as some help with power tools during construction of the apparatus. I discussed my results with my parents.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Jad Farhat

Project Number
J1806

Project Title
How Does Density Affect Buoyancy?

Abstract

Objectives/Goals
My goal in this project was to find the density of different liquids and the density of a boiled egg and try to predict whether the egg will sink or float. I decided to do this project to learn more about the density of liquids and how they affect whether an object will sink or float. How does the density of an object affect the buoyancy of a liquid? My goal is to prove that the liquid with lower density than the boiled egg will result in the egg sinking, and vice versa.

Methods/Materials
The liquids I used were fresh water, salt water, corn oil, orange juice, and milk. I calculated the volume of the boiled egg by using the water displacement method and the mass by weighing it on the electrical balance. I calculated the density of each liquid by measuring the mass using the same electrical balance and used a measuring cup to find the volume of each liquid. I then predicted whether the egg will sink or float. Then I carefully tested to confirm my predictions.

Results
After conducting 5 different measurements of the density for each of these 5 liquids:
oil, milk, water, orange juice, and salt water. I calculated the average density of each liquid and used it for the experiment.
As a result the egg has sank in all liquids except the salt water because the salt water's density was higher than the egg's density. All of the other liquids' densities were lower than the egg's density, so the egg sank in them.

Conclusions/Discussion
I concluded that objects with a density lower than the liquid will float, and objects with a density higher than the liquid will sink. Knowing that the density of an object will vary based on its volume and mass. So to answer a common question, "Will an object made of cement or steel object float in water?" To properly answer the question we will need to determine it's volume and mass to get it's density and compare to the liquid's density.

Summary Statement
I calculated the density of 5 different liquids and a boiled egg and predicted whether the egg will sink or float in each liquid.

Help Received
I tested and experimented on my own with the help of internet searches on density.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Trevor U. Hurvitz

Project Number

J1807

Project Title

Fighting Fire with Sound

Abstract

Objectives/Goals

Viet Tran and Seth Robertson built the first handheld fire extinguisher that uses sound instead of the toxic chemicals of a typical extinguisher. Yet, prior research in this field has not yet specified a certain frequency that excels above others. The purpose of this experiment is to find the most effective frequency of sound for extinguishing fire in the least amount of time with my own customized, sound-powered fire extinguisher based on Viet Tran and Seth Robertson#s model.

Methods/Materials

-BASIC MATERIALS

Lighter fuel (rubbing alcohol), A timer, steel pan

-SOUND-POWERED FIRE EXTINGUISHER

computer (sound generator), Appropriate cords to connect to the subwoofer, 12 inch or 30.5 cm cardboard collimator (cylinder around the subwoofer) with a whole at the end with a diameter of 13 cm, 12 inch subwoofer, 100 Watt Amplifier (power for subwoofer).

Tested the time (sec) that it took for each frequency to extinguish fire.

Results

The results concluded that 60 Hz, with an average extinguish time of 0.447 seconds, is the most effective frequency for extinguishing fire. Out of the frequency range of 20 Hz through 60 Hz that successfully extinguished fire, 60 Hz had the fastest extinguish time, 0.126 seconds faster than its follow up frequency, 40 Hz.

Conclusions/Discussion

60 Hz was the most effective frequency of sound for extinguishing fire. Current fire suppression techniques release toxic chemicals or simply create a larger mess of some sort, but sound only sends energy through what already exists to stop a fire. This information may be applied to future work with sound and its fire extinguishing capabilities that may prove to be better than our current techniques.

Summary Statement

I found that 60 Hz was the most effective frequency of sound for extinguishing fire in the least amount time, using a homemade sound generator system.

Help Received

Research Forester David R. Weiss, Ph.D. gave me tips on how to design my experiment and I built and performed the experiment myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Georgia Hutchinson; Linus Upson

Project Number

J1808

Project Title

Material Density and Charged Particle Occurrence in a Cloud Chamber

Abstract

Objectives/Goals

Build a cloud chamber and observe charged particles. Test how the density of various materials affects the number and type of charged particles observed.

Methods/Materials

Constructed a cloud chamber, in a dark room, consisting of crushed dry ice, a glass tank (made air-tight with window sealant), a heating pad, 99% isopropyl alcohol, a dark metal sheet pan. Recorded the number of charged particles seen in a cloud chamber for one minute, with and without a steel plate (1 cm thick) at different altitudes.

Results

More charged particles were seen at 700 meters above sea level than at 146 meters above sea level. The steel plate reduced the amount of charged particles seen at both altitudes. With a steel plate, the number of muons seen increased by 7%, but the number of particle decays and electrons was also decreased by 7%.

Conclusions/Discussion

The steel plate reduced the number of charged particles observed in a cloud chamber by a substantial amount, which leads to the conclusion that steel is an effective way to insulate against charged particles. At a lower altitude, fewer charged particles were seen, leading to the conclusion that air also functions as an insulation against charged particles. Air is much less dense than steel, so a much greater quantity was required to block a similar number of charged particles.

Summary Statement

Using a cloud chamber, we determined that both steel and air are effective insulators against charged particles.

Help Received

We adapted a design for a cloud chamber from Science Friday, improving on it considerably through many iterations. We performed the experiments ourselves.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Michael R. Julian

Project Number

J1809

Project Title

Magnetic Levitation vs. Gravity

Abstract

Objectives/Goals

The goal of my project is to answer the question: how does the magnetic levitation distance between two objects vary with weight? My hypotesis is that if I align two magnets, both with their south poles facing each other and I increase the mass on one of the magnets, the distance will get smaller.

Methods/Materials

I created a vertical structure out of LEGO building blocks, then I added 4 magnets onto the stationary base and the top mobile disk. I also used several LEGO bricks of known and equal weight to increase the mass of the top mobile disk. The experimental procedure included the following steps: 1) add two LEGO blocks on top of the mobile disk to increase its mass, 2) measure and record the distance between the disk and the stationary base. I repeated this procedure several times and recorded the data in my notebook. I performed three trials.

Results

I plotted the experimental data for three trials into a graph using the Matlab software. I also computed and plotted the average of the three trials. After I took a look at the graphs and the data I collected, I concluded that my hypothesis was confirmed. The distance between the stationary base and the mobile disk decreased every time I added more mass.

Conclusions/Discussion

In this experiment the role of gravity is shown to prove that if you add mass to an object that is suspended in the air, due to magnetic levitation, then the distance between the object and the base will decrease. It was interesting to learn that the relationship between weight and distance is non-linear.

Summary Statement

This project demonstrates that the distance between two objects, due to magnetic levitation, decreases non-linearly as the gravity force increases due to the increased weight of the top object.

Help Received

My father taught me about magnetic levitation and helped me design the LEGO structure. I built it and made all the measurements myself. My mother helped me to plot the data in Matlab.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Mike S. Kostolansky

Project Number
J1810

Project Title
Separating Dyes Using Gel Electrophoresis

Abstract

Objectives/Goals
I wanted to find why dyes being tested (Orange G, Xylene Cyanol, Malachite Green, Crystal Violet) would go the fastest and furthest. I also wanted to learn how to create and use a Gel Electrophoresis apparatus using materials found in a regular household and minimal online shopping. I hypothesized that the Orange G ye would go through the apparatus the fastest and furthest because it had the least amount of base pairs and would therefore go through the microscopic holes in the agarose faster.

Methods/Materials
Dyes (Orange G, Xylene Cyanol, Malachite Green, Crystal Violet), steel wire, small plastic box, agarose, a pipette, TBE Buffer, five 9-volt batteries, styrofoam comb, a pair of pliers, a butter knife, and two alligator clips. Melt and pour the agarose into the box and insert the comb. Let it set for thirty minutes. Cut two slits for electrodes with a knife and insert the steel wires as electrodes. Mix the TBE buffer with four times as much tap water. Add enough buffer to cover the surface with 0.3 cm. Use the pipette to get the four dyes and insert them into the wells created by the comb. Connect the five 9-volt batteries and attach the alligator clips to them. Attach the alligator clips to the steel wire and let the gel run for fifty minutes.

Results
In all of the tests ran the Orange G dye traveled the furthest with an average of 3.4 cm traveled. The Malachite Green came in second averaging 1.975 cm. Xylene Cyanol came in third averaging 1.725 cm. The Crystal Violet came in last averaging 1.30625 cm. In all of the tests Orange G did come in first but in the first two tests, the Malachite Green and Xylene Cyanol traveled the same distance in the first two tests.

Conclusions/Discussion
I found that the Orange G dye (50 base pairs) did go the fastest and furthest in the Gel Electrophoresis apparatus. This proves my hypothesis that because it has the least base pairs, it will travel through the apparatus the fastest and furthest. One hole in this theory is that even though the Xylene Cyanol had the highest amount of base pairs (150 base pairs) it beat out Crystal Violet (125 base pairs) and almost tied with the Malachite Green (85 base pairs). This means that either I had impurities in apparatus, gel, or TBE buffer, or that the Xylene Cyanol dye has special properties that allow it to somehow travel faster and farther even though it has a large amount of base pairs.

Summary Statement
I used a Gel Electrophoresis apparatus to compare the distance migrated between dyes commonly used as marker dyes in Gel Electrophoresis to find out what the differences were and why they were that way.

Help Received
None. I built and performed the experiments myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Rachel D. Lin

Project Number
J1811

Project Title
Determining Speed of Light in Corn Syrup Solutions

Abstract

Objectives/Goals
This experiment studied the rate at which the speed of light decreased as the concentration of corn syrup in water increased.

Methods/Materials
Method 1:
Rotating circular platform with degree units on sides, protractor, laser pointer, corn syrup, water, container, graduated cylinder. Measured change in angle of laser beam for each concentration.

Method 2:
Rotating circular platform with degree units on sides, laser pointer, corn syrup, water, container, graduated cylinder. Found critical angle.

Method 3:
Rotating circular platform, laser pointer, corn syrup, water, hollow prism, graduated cylinder, tape measure, tape/marker, wall. Found minimum deviation angle.

Results
The speed of light decreased by 4.35*10^6 m/s every 20% increase in the concentration of corn syrup.

Conclusions/Discussion
This experiment compared the methods used and found that the minimum deviation method was the most accurate. The results of this experiment showed a regular decrease in speed of light as the concentration of corn syrup increased.

Summary Statement
My research showed a constant decrease in speed of light as the concentration of corn syrup increased.

Help Received
My science teacher Mr. James Jackson and another science teacher Mrs. Kim Miller read over my results and data analysis. I constructed and executed my experiment myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Ellorie Mariano

Project Number
J1812

Project Title
How Does Color Affect Heating by Absorption of Light?

Abstract

Objectives/Goals
The objective of my experiment was to figure out the reasons of how and why heat is absorbed faster into specific colors compared to other colors by using light, supported with statistical analysis and the engineering design process. Find which colors do so. My hypothesis was that darker colors would heat up at a faster rate, while lighter colors would heat up at a slower rate.

Methods/Materials
I constructed a new contraption using thermostats, various colored cloth, plastic bottles, a heat lamp, a fan, wiring, boxes, and a thermometer to measure the temperature of colors within a designated area for heat to vent out to. 8 colors of cloth were wrapped around bottles to be placed in the contraption and timed with a stopwatch as each temperature reached 90 degrees. Data was recorded in statistical data formats for easier comparison among the times of the colors.

Results
Repeated test trials of the eight colors showed that black had the fastest trial times and averages (5 minutes and 41 seconds average), while white withstood timing the longest (10 minutes average). Darker colors appeared in the faster range, while lighter colors appeared in the slower range during timing.

Conclusions/Discussion
Relating my concept to my research, I soon came to the conclusion that colors with longer wavelengths in nano-meters from the electromagnetic spectrum (lighter colors) will result in longer times, while colors with shorter wavelengths (darker colors) will result in faster times. I was able to prove this theory through my accumulated results, which showed that lighter colors, such as yellow and orange, had longer times, and darker colors, like blue and purple, had shorter times. Research from online articles had also supported my new theory, and my hypothesis was proven correct.

Summary Statement
By using my innovative contraption to provide heat and measure the temperature of each color, I was able to show the reasons of how and why specific colors absorbed more heat than other colors.

Help Received
My father was the reason being that I had prior knowledge of wiring. I applied my previous knowledge of basic wiring structures from him to help me plan and construct a contraption all on my own to relate to my concept. My science fair coordinator and science teacher gave me constructive criticism.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Arsh Muhib

Project Number
J1813

Project Title
Building a 360 Degree Periscope

Abstract

Objectives/Goals
Build a 360-degree view periscope with no image disorientation, maximum comfort and minimum space requirement.

Methods/Materials
Materials - Cylindrical wine paper box, Mirrors, dove prism.

Obstacle 1 - Method - I modified a standard periscope such that the top mirror of the periscope rotates 360 while the bottom mirror stays stationary. I mounted the periscope mirrors on the cylindrical box in such a way that I could rotate the top mirror in all directions. Findings 1: When the position of the periscope mirrors were not exactly opposite to each other, then the image did not have the correct orientation.

Obstacle 2 - I conducted an experiment to understand the relationship between the rotation of the top mirror of the periscope and the image tilt.I rotated the top mirror of the periscope and measured the tilt of the image for each position. Findings 2: The degree of tilt in the image was equal to the degree of rotation of the top mirror of the periscope.

Obstacle3 - I had to fix the tilt. I found that dove prisms can be used to rotate an image. If you rotate the dove prism by x amount of degrees, it rotates the image by 2x amount of degrees.I mounted a dove prism in front of the viewing mirror of the periscope. I rotated the top mirror of the periscope and then rotated the dove prism at the viewing end until the image orientation was fixed. Findings 3: I could fix the tilt in the image of the periscope by rotating the dove prism by half the degree of rotation of the top mirror.

Results
I was able to make a 360-degree periscope where the top mirror of the periscope rotates in all directions. The mirror at the viewing side has a dove prism attached to it that can be rotated to cancel the tilt of the image. The observer did not have to change his/her position.

Conclusions/Discussion
A 360-degree periscope with no image disorientation and no observer movement can -
1. Make life of sailors and soldiers in submarines and armored vehicles much more comfortable.
2. Free up precious space in submarines and armored vehicles because of no observer movement.
I can do a lot of improvements like reducing the size of the periscope, provide magnification of the image, provide the observer a display of the direction in which the top mirror is pointing etc. I can build a single

Summary Statement
I built a 360-degree view periscope with minimum image disorientation, maximum viewing comfort, maximum stealth and minimum space requirement for an observer.

Help Received
My dad helped me wherever I had to cut and trim cardboard and wine paper gift boxes using a sharp object

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Thomas A. Radujko

Project Number
J1814

Project Title
Can Light Curves Determine the Outcome of a Supernova?

Abstract

Objectives/Goals
The objective of this project is to determine if the light curve of a type 1A supernova compared to the light curve of a stellar mass black hole can help predict that the supernova will become a black hole.

Methods/Materials
FITS file stacking and converting program (IRIS/DS9), photometry analysis program (Salsa J), LCO global telescope network, Windows 7 computer. I did not modify the three downloaded programs used to conduct my experiment. Converted, stacked, and analyzed FITS files of Gaia 16 bq1 (supernova) and 1118 Rosa (black hole) to produce two light curves for comparison.

Results
Light curve graphs were compared and showed no correlation, though the data was inconclusive because the black hole and supernova were of varying sizes and the time period during which the images were taken was not at the very end of the supernova's magnitude decay or the formation of the black hole. Also, the x-scale (time when image was taken) units on the graphs of the supernova and black hole light curves were different.

Conclusions/Discussion
The light curves being compared appeared to have no effect in predicting the supernova's outcome. Though this statement is not conclusive because my results were not statistically significant due to differences between these celestial bodies' formation and size.

Summary Statement
My results showed that a supernova's light curve cannot help determine if that supernova will form a black hole (as its outcome), though they were inconclusive and not statistically significant.

Help Received
I converted, stacked, analyzed, and produced the light curves of the FITS files myself, but spoke to professor Omar Blaes at UCSB and Dr. Curtis McCully in the supernova division of the LCO headquarters. Also, the astronomer Fraser Louis helped me find the black hole FITS files. Finally, my

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Eliah R. Reeves

Project Number

J1815

Project Title

How Strong Is Gravity Really?

Abstract

Objectives/Goals

Can I build an apparatus to measure gravity? Which pendulum bob will provide the best results? Can I miniaturize my experiment to make it more portable?

Methods/Materials

-Have someone hold the bar in place.
-Make sure you, and the person holding the bar have gloves, and a welding mask.
-Weld the bar horizontal bar onto the vertical bar.
-Grind notches in the vertical board so that the string doesn't slide.
-Cut out square of wood to reference swings with.
-Calculate the middle of the board by dividing the total length by 2.
-Connect the string to the horizontal bar.
-Screw board to vertical bar.
-Put blue tape roughly every two inches for a reference point.
-Glue screw in corner for reference
*Camera apparatus
-Connect bolt to camera
-Clamp bolt in vice.
*To take measurements.
-Tie Pendulum bob to the end of the string.
-Press record on the camera.
-Pull the weight back to the screw.

Results

Average -range +range
bike wrench 8.61 7.20 10.02
deflated balloon 12.38 11.28 13.48
half inflated balloon 9.62 8.56 10.67
lead cross 8.43 5.92 10.94
sharpie marker 12.86 11.32 14.41
small pendulum 9.13 9.13 9.13 All values in m/S^2

Conclusions/Discussion

I found that I could create an apparatus that used a pendulum to measure gravity. The apparatus was made

Summary Statement

Can I build a device that measures gravity, determine the best object for the pendulum bob, and get comparable results if its miniaturized.

Help Received

Mr. Sewell, Ms Bertram, and Ryan Reeves

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Alice Romano

Project Number
J1816

Project Title
Measuring Earth's Properties

Abstract

Objectives/Goals
The goal of my science fair experiment is to measure some of the physical properties of our planet. In particular, I focused on measuring the Earth's gravitational acceleration.

Methods/Materials
I constructed a pendulum to help me measuring the gravity acceleration. With the pendulum I tested my hypothesis which was, If I used a longer string then the pendulum would swing back and forth for a longer amount of time. I tested multiple string lengths with some weights. When I was done,using my experiment results, I used the equation modeling the pendulum dynamics to calculate the gravity acceleration.
Thirteen experiment sets were executed with two different values of weights (91.05 g & 128.45 g), two different lengths of the string (153 cm & 42.53 cm) and 4 displacements from the equilibrium (2,5 cm;5 cm;10 cm;15 cm).
The weight consisted of one small orange(I originally wanted to use an apple in honor of Sir Isaac Newton but the apple was over the maximum weight that could be measured by the precision digital scale I used).

Results
During each experiment sets, I executed three experiments. During each experiment I measured with a stop-watch the time of ten oscillations. Finally I took the average of the three experiments and divided by ten in order to obtain the average time of oscillation during each experiment set.
I made seven qualitative observations and one quantitative observations (computation of an estimated value of the gravity acceleration).

Conclusions/Discussion
For this experiment, my hypothesis was that a longer string will cause the pendulum to go back and forth in a longer amount of time, with respect to using a shorter string. After doing the experiment and looking through my observations, I found that my hypothesis is correct. It is true that if I use a longer string it takes the pendulum a longer amount of time to go back and forth.
By using the experimental observations I computed an estimated value of the local gravity acceleration. In particular, I obtained the following estimated value of the local gravitational acceleration $g=9.82\ m/s2$ (notably this value is very close to the most accurate one reported in physics books which is 9.80665) What i got from the equations was reasonably close to the actual one. Also my hypothesis is correct.

Summary Statement
Measuring by a custom-made pendulum the gravitational acceleration at Earth's surface

Help Received
Dr. Marcello Romano, my father, University Professor in Mechanical and Aerospace Engineering

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Micaela A. Roth

Project Number
J1817

Project Title
The Physics of a Marble Run

Abstract

Objectives/Goals
The first experiment is to test an equation to relate the height of the track to the maximum radius of a loop the track can have for a marble to complete the loop without falling. Additionally, I tested whether this radius is dependent on the weight of the marble. Also, I analyzed the relationship between the height at the top of the run and the speed at the end, and whether the marble's mass effected this velocity.

Methods/Materials
Pipe insulator, scissors, packaging tape, cardboard, 3 marbles with different masses, meter sticks.
1. Tested maximum radius of loop at 10 different heights.
2. Measured velocity at end from 10 different heights.
3. Tested 3 different masses and measured the velocity at the end from 1 height.

Results
1. The maximum radius equation from MIT was not supported, but my direct variation hypotheses for both the mass and the height were supported.
2. The velocity equation was supported with very little error.
3. The mass hypothesis was supported - the velocity was larger with more mass.

Conclusions/Discussion
The maximum radius increased as the height increased and also increased as the mass increased. The equation from MIT was not supported, and this might have been due to the error in my structure. The velocity equations were both supported with error that was within the accuracy of the measurements. The velocity was also larger as the mass increased, which suggests that the hypothesis to the side question was supported - there is a relationship between the variables.

Summary Statement
I analyzed several physics equations and concepts using a roller coaster track and different mass marbles and showed that the maximum radius of a loop and the velocity at a certain point on the track can be easily found using equations.

Help Received
One of my STEM teachers, Dr. James Li helped me with the scientific method and with coming up with the research questions.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Vivian B. Tien

Project Number
J1818

Project Title
Salt Content and Buoyancy

Abstract

Objectives/Goals
My project aims to use household items to build a device that effectively measures the salt content and buoyant force in a body of water. Using this device, I want to prove that the higher the salt content there is in the water, the more buoyant the objects floating in the water will be.

Methods/Materials
I created the base of my device with a waterbottle and used rubberbands to attach a metal rod to its side. For the part that was used to measure the buoyant force, I used bent paperclips to attach a bicycle spoke to the metal rod, leaving the rings loose to prevent friction. I used the tip of a syringe to attach a ping pong ball to the bottom of the bicycle spoke. My device measures the salinity and the buoyant force by finding how much weight is required to submerge the ping pong ball just below the surface of the water. The more weight is required, the more salt content is in the water. The salt content causes the buoyant force to be stronger.

Results
The amount of salt measured by my device stays consistent throughout the ten trials. In a couple of trials, the results did fluctuate, but even then, there was only a difference of 1 gram. The higher the salt content was, the more weight I needed to submerge the ping pong ball, meaning that salt content does boost buoyancy.

Conclusions/Discussion
The results from my experiment support my hypothesis that the higher salt content there is in the water, the more buoyant the objects floating in the water are. The device is consistent in its data as shown by my ten trials. I succeeded in creating it with household items, without using the total dissolved salts method or the electrical conductivity method. My device can measure the salt content in the water at the source, which makes it easier to track the changing levels of salinity in water.

Summary Statement
I created a device using only household items that effectively measures the salt content and the buoyant force in a sample of water.

Help Received
My father taught me how to use pliers to bend the paperclips around the metal rods. My Science teacher reviewed my report.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Josephine A. Tsai

Project Number
J1819

Project Title
How Does Bow Tension Affect the Sound Produced by a Violin?

Abstract

Objectives/Goals
The objective of the experiment was to examine how violin bow tension affects the loudness of the sound on a violin. It is expected that higher hair tension on a bow will produce louder sounds. This is because higher tension creates more friction with the string, causing the string to vibrate more and thus produce a louder sound.

Methods/Materials
A full-size violin and bow were used in the experiment. Three bow hair tensions (measured as the distance between bow hair and the stick at 0.5, 1, and 1.5 cm) were tested on each of the four strings. For each tension, ten notes were played and the average sound (in decibels) of the ten notes was obtained. The loudness of the sounds was measured by a Digital Sound Level Recorder.

Results
The notes played by the bow with the highest hair tension produced the loudest sound while the notes played with the lowest hair tension produced the quietest sound. The same relationship exists for all four strings.

Conclusions/Discussion
The experiment confirms the hypothesis that higher bow hair tension increases the loudness of sounds.

Summary Statement
My project is about measuring the affect that bow tension has on the loudness of the sound produced by a violin.

Help Received
I designed and carried out the experiment by myself.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Noelle K. Turko

Project Number
J1820

Project Title
How Does the Temperature Affect the Speed of Nylon String Guitar Waves?

Abstract

Objectives/Goals
The objective of my science fair project was to determine if temperature affects the speed of nylon string guitar waves.

Methods/Materials
I placed my iPhone inside my nylon string guitar and used the camera to record the transverse waves as they traveled on the guitar strings. I tested the strings at 51-47 degrees Farenheit, 68 degrees Farenheit, and 86 degrees Farenheit.

Results
My results in the cold temperature, the transverse waves were shorted than in the warmer temperatures. Additionally, the wave on the string in the cold temperature stopped sooner than it did in the hot or normal temperatures.

Conclusions/Discussion
After I conducted my experiment I learned that my predictions were correct. The warmer the temperature, the longer the wavelength.

Summary Statement
I tested the affect of temperature on transverse waves on nylon guitar string and found the colder the temperature, the slower and shorter the wave.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Yusuf A. Usman

Project Number
J1821

Project Title
How To: Breaking the Fire Barrier

Abstract

Objectives/Goals
The objective of this study is to find out what range of frequencies paired with which decibel counts extinguish a fire of a given flame the fastest, and most efficiently.

Methods/Materials
Subwoofer, timer, ruler, frequency generator, and decibel meter. Measured the decibel output of the subwoofer, which was connected to the frequency generator, the flame height of the lighter, and timed how long it took to extinguish the flame.

Results
After different flame heights, frequencies, and decibel counts were tested, the results showed that 40 Hz worked the best followed by 35 Hz, 30 Hz, 25 Hz, then 20 Hz which didn't extinguish anything. These frequencies were most efficient paired with the higher experimented decibel count of 94.1 dB. The results were the same for a flame height of 1 cm and 2 cm.

Conclusions/Discussion
After the tests were completed, it was concluded that the best frequencies to use to extinguish a fire are between 30 and 40 Hz. It is also the most efficient to extinguish the fire from a distance of 1 cm or less with a high decibel count because the higher the decibel count, the faster the flame gets extinguished.

Summary Statement
I identified the most efficient ranges of frequencies and decibel counts to use when extinguishing a flame at a given height.

Help Received
My mentor, Ms. Najwan Naserelddin, helped develop my understanding of sound physics.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Herbert Roger C. Vega

Project Number
J1822

Project Title
Extinguishing Fire Using Sound

Abstract

Objectives/Goals
The objective of this project is to see if it is possible to extinguish a controlled fire using sound.

Methods/Materials
Use a subwoofer or a speaker that has a strong bass and a usb cord. Plug the speaker or subwoofer into the computer or laptop and put it at the highest volume. Load a 60 hertz sound file (Youtube is an option). Light a butane lighter. Aim the speaker at the lighter. Record if the lighter goes out or not and how long it takes using the timer. Repeat steps above but by increasing the number of hertz in increments of 10.

Laptop; Usb Subwoofer; Timer; Butane Lighter; Sound Files.

Results
I tested the subwoofer from 50 hertz to 100 hertz, and recorded the times. At 50 hertz the subwoofer was most effective at putting out the flame, but the intervals between each test in time were small. During all tests the lighter went out.

Conclusions/Discussion
My results support my hypothesis that the flame would be extinguished. This project can be used in a case of an emergency and it would not leave dangerous chemicals behind like other types of fire extinguishers. In the future if I were to do this again I would build a fire extinguisher that uses a subwoofer, and put it in a larger scale.

Summary Statement
This project is about extinguishing fire using low frequency sound waves.

Help Received
None; I researched for, designed, and performed this project on my own.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Vivek Vijayakumar

Project Number

J1823

Project Title

A Comparison of the Morphology, Mass, and the Expansion Velocities of Planetary Nebulae

Abstract

Objectives/Goals

The subject of planetary nebulae is one of which we still have much to learn. This project intended to use the known and acquired details about the morphology, central star mass, and the expansion velocities of specific planetary nebulae to look for correlations between these three characteristics.

Methods/Materials

Images of 10 planetary nebulae taken with an astrophotography setup were combined with current scientific research as well as historical data to meet this end.

Results

No correlations were found between any of the three properties. However, most of the central star masses did stay below 1.44 solar masses, excluding AGB (asymptotic giant branch) stars and binary systems. Most expansion velocities were in the range of 22 to 43 km/s, excluding AGB stars once again.

Conclusions/Discussion

Since no definite correlations are found, it is concluded that the hypothesis is incorrect about the relationships between the morphology, central star mass, and expansion velocities. However, it is also concluded that most planetary nebulae with single white dwarf central stars have masses from 0 to 1.44 solar masses, and expansion velocities ranging from 20 to 45 km/s. This project demonstrates the evolution of planetary nebulae and their progenitors, from red giants to white dwarfs.

Summary Statement

I measured different properties of multiple planetary nebulae and compared them, in order to find correlations, relationships, or oddities among them.

Help Received

Kin Searcy of the San Diego Astronomy Association reviewed some parts of this project, and provided input.

CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)
Chunyi Zhou

Project Number
J1824

Project Title
Substrate-Liquid Wettability

Abstract

Objectives/Goals
The science behind the phenomena of wettability is a fascinating one that finds its applications in many fields like adhesives, stain repellents, printing, and medical devices. Maximizing wettability is highly desired in many applicatons e.g. improving adhesion for adhesives or preventing nonspecific protein adsorption for implanted medical devices.
The objective of this study is to understand what kind of liquid and solid substates combination would yield the greatest wettability using the contact angle technique as a measure.
Using the information obtained in this study, people working in applications that require optimal wettability can achieve their goals through adjusting the surface tension/surface energy.

Methods/Materials
Measurement software (ImageJ), Camera, Syringe with 0.1 ml increments, Stainless steel, Gold, Copper, Polyethylene terephthalate(PET), Teflon, Epoxy, Ceramic, Silicon, Glass slides, DI water, Cooking oil, Acetone, Isopropanol, 9% Polysorbate-20 (9% diluted).
Record room temperature/humidity. Place dried substrate (rinsed by DI water and acetone) on the sample holder. Drop 0.05ml liquid from syringe onto substrate. Take the photo by camera. Analyze photo by software to get contact angle data.

Results
The average contact angle of DI water on stainless steel was 57.5 degrees, which suggested a low wettability. The same was true for 9% Polysorbate-20 on gold (contact angle of 46.3 degrees). At the same time, the combination of DI water on gold was approximately 70.8 degrees, suggesting a very low wettability; moreover, DI water on teflon demonstrated extremely low wettability (contact angle of 104.5 degrees). In contrast, a very high wettability was shown with isoproponol on all of the substrates: the contact angles were too low to measure on all the substrate except Teflon (21.7degrees).

Conclusions/Discussion
The combination of a high surface energy substrate and a low surface tension liquid yields maximum wettability. It is demonstrated by the results of isopropanol on all substrates except teflon and also by the results of cooking oil on silicon. All of them had extremely low contact angles, i.e. very high wettability. The opposite is to obtain minimum wettability: a low surface energy substrate and a high surface tension liquid are needed. For instance, DI water on teflon showed low wettability; in other words, the teflon is very hydrophobic.

Summary Statement
How to maximize the wettability (measured by contact angle) of a solid surface

Help Received
I designed the experiments through internet search and text book reading. My science teacher helped to review my proposal. I performed the test and data analysis by myself. Dr. Xinpei Cao from Henkel Electronic Materials provided the substrates for experiments.